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ABSTRACT

Materials contained in this guide present competencies describing welding skills necessary for success in initial employment or applicable to advanced educational placement, and may be used by administrators, students, and secondary and postsecondary vocational teachers. The student outcomes section provides guidelines for planning of and preparation for job opportunities and placement, for advanced placement in postsecondary education, and for allowing high school credit for previous experiences. Section 2 lists twenty welding competencies needed for initial employment (e.g., fusion welding mild steel, and making flat position single pass fillet welds on aluminum sheet using the gas tungsten arc welding process. Under each competency is a description of circumstances under which the student will demonstrate the skill and a list of criteria of acceptable performance. A third section lists enabling tasks for each competency, describing activities necessary for developing the particular job skill. A glossary, a form for recording student achievement, and a class progress chart are also included. (TA)

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competencies for articulation

WELDING

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A Project of the
Lincoln Public Schools
Educational Service Unit No. 6
Southeast Community College

COMPETENCIES FOR ARTICULATION

WELDING

An Exemplary Project in Vocational Education
Performed Pursuant to a Grant From the
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CONTENTS

	Page
Preface	i
Acknowledgements	ii
Introduction	iii
Student Outcomes	1
Job Opportunities	2
Advanced Placement Policy Statement	3
Advanced Placement Credit	4
High School Credit	6
Competencies	7
No. 1 Cutting - Gas	8
No. 2 Flat fusion - Gas	9
No. 3 Horizontal fusion - Gas	10
No. 4 Vertical fusion - Gas	11
No. 5 Overhead fusion - Gas	12
No. 6 Braze: flat & horizontal - Gas	13
No. 7 Stringer beads: flat, horizontal, vertical up - Arc	14
No. 8 Pad: flat - Arc	15
No. 9 Flat: T, lap, butt - Arc	16
No. 10 Horizontal: open corner, T, lap - Arc	17
No. 11 Vertical down: open corner, T, lap - Arc	18
No. 12 Flat: outside corner, lap, T, butt - MIG	19
No. 13 Horizontal: outside corner, lap, T, butt - MIG	20
No. 14 Flat: spray, butt - MIG	21
No. 15 Flat: beads, aluminum - TIG	22
No. 16 Flat: single pass, aluminum, T - TIG	23
No. 17 Flat: single pass, aluminum, butt - TIG	24
No. 18 Flat: multi-pass, aluminum, T - TIG	25
No. 19 Flat: multi-pass, aluminum, butt - TIG	26
No. 20 Horizontal: multi-pass, aluminum, T - TIG	27
Enabling Tasks	28
Glossary	35
Individual Student Record	37
Class Competency Record	39

PREFACE

More emphasis than ever is being given to educational competencies. The public is questioning the basic abilities of graduates and is demanding that schools be more accountable for student performance. Educators are determined to give a clear definition of what students are expected to learn.

Although many people are interested in competencies, few seem able to explain what they mean or give specific examples. Staff members of this project can. They have addressed an important problem—articulation between schools—in terms of the competencies the students should have.

Defining competencies will not necessarily improve articulation. That improvement demands understanding, trust and cooperation among all concerned. Neither does the definition assume full-fledged, competency-based education — for that requires a complex system for instruction, assessment and certification that takes time to develop.

While these competency statements are not the whole picture, they are a significant achievement. If used properly, they will contribute to both better articulation and improved learning.

Ron Brandt,
Associate Superintendent for Instruction
Lincoln Public Schools

ACKNOWLEDGEMENTS

The significant contributions of committee members in the development of these materials are greatly appreciated. Members representing three educational agencies, the Lincoln Public Schools, Educational Service Unit No. 6 and Southeast Community College, combined skills to provide helpful materials for articulation purposes to teachers and administrators.

Persons representing business and industry in Lincoln, Milford and other cities in the Education Service Unit and Southeast Community College district also contributed expertise through a series of meetings. Vocational teachers from Lincoln and other communities, although not directly involved in the project, made similar contributions as materials developed.

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INTRODUCTION

Professional staff members of the Lincoln Public Schools, Educational Service Unit No. 6, and the Southeast Community College have joined with representatives of business and industry in developing these instructional materials.

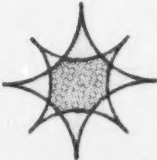
The educational materials in this guide may be used by administrators, students, and secondary and post-secondary vocational teachers. They are designed to help students move from class to class, grade to grade, secondary studies to post-secondary school or employment. The materials consist of:

1. Student Outcomes
2. Competencies for Job or Advanced Placement
3. Enabling Tasks
4. Glossary of Terms
5. Class Progress Chart, and
6. Record of Individual Student Skill Achievement

This information is not limited to a particular vocational course but to a set of competencies. These competencies describe skills necessary for success in initial employment or applicable to advanced placement for educational purposes.

Some schools may be able to provide more opportunities for students to complete competencies and tasks than others. Whatever the case, teachers and administrators will find the materials helpful when planning programs for students and for determining what educational experiences may be made available to them. Students may use the materials to understand and plan the skill developments necessary for employment and additional education.

Teachers and students should keep records of competencies as they develop. Two record forms, one for charting competencies of all students in a class, the other an individual student record, are included in the materials. These records may be used by students and teachers to chart progress toward specific job skills, and as achievement records for presentation with job or post-secondary school applications.



Student Outcomes

Information that will help administrators, teachers and students plan programs at both secondary and post-secondary levels is provided. It applies to:

1. Planning of and preparing for job opportunities and placement;
2. Planning of and preparing for advanced placement in post-secondary education;
3. Allowing high school credit for previous experience.

"Student outcomes" describe what a particular instruction has prepared a student to do.

JOB OPPORTUNITIES

Many welding positions available in the Lincoln community and in surrounding areas are listed along with the Dictionary of Occupational Titles and the Office of Education codes.

Recommended competencies to be developed by students for initial employment are given. Students may use this information to plan and prepare school experiences properly.

Dictionary of Occupational Titles Code Number	Office of Education Code Classification	Occupational Title	Competencies Necessary for Initial Employment	Recommended Additional Training
616.380	17.2304	Welder, pipe making	12	Machine shop, Metals, Forging
810.131	17.2306	Welder, supervisor, pipeline	1 through 20	Certification
810.782	17.2306	Welding machine operator, arc	1 through 11	Certification may be necessary
810.782	17.2306	Welder, seam	12	Metals
810.782	17.2306	Welder, butt	12	Metals
810.884	17.2306	Welder, apprentice, arc	7 through 11	Metals
810.884	17.2306	Welder, arc		
		Boilermaker welder	7 through 11	Metals
		Gas shielded arc	12 through 20	Metals
810.884	17.2306	Welder, gun		
		Hand submerged arc	12, 13	Metals
		Heliarc	14 through 20	Metals
810.884	17.2306	Welder, tack	7, 12, 15	Metals
811.081	17.2306	Welding, engineer	1 through 20	Post secondary experience
811.782	17.2306	Welding machine operator, gas	1, 2	Metals
811.884	17.2306	Welder, gas, automatic	1 through 6	Metals
811.884	17.2306	Welder, apprentice, gas	1 through 6	Metals
812.884	17.2306	Welder, production line	1 through 20	Metals
812.884	17.2306	Welder apprentice, combination	1 through 20	Metals
812.884	17.2306	Welder, combination and repair	1 through 20	Metals
819.301	17.2306	Welder-Fitter	1 through 20	Metals
819.301	17.2306	Welder-Fitter, apprentice		
		Arc	7 through 11	Metals
		Gas	1 through 6	Metals
819.381	17.24	Welding tester	1 through 20	Metals
819.887	17.2306	Welder, helper	1, 2, 7	Metals

Most of the above occupations require on-the-job experience, in addition to training, to become thoroughly competent.

ADVANCED PLACEMENT POLICY STATEMENT

Southeast Community College
Lincoln and Milford Campuses

The College believes that students should be recognized and rewarded for previous educational and occupational experience when that experience results in competence in areas normally addressed by the courses and programs of the College. Advanced standing may be awarded with full credit, up to limits established by each department of the College but not exceeding 30 credit hours. Credits earned in other accredited educational institutions in excess of 30 hours may be accepted by the department.

The College has established the following methods to enable students to gain advanced standing:

CREDIT BY EXAMINATION

Some courses have been identified which may be completed by examination. Testing devices and evaluation procedures will vary according to the course, departmental requirements and the amount of credit being advanced.

To apply for credit by examination, the applicant must have been accepted for admission to the College and have established a transcript. Applications for Credit by Waiver or Examination must be submitted to the department from which credit would be granted.

Applicants for credit by examination must pay the following: 50% of the current per credit hour fee for each credit hour attempted by examination. This fee must be paid prior to the examination.

A "Credit by Examination Notice" will be forwarded to the Campus Registrar for all credit granted by examination. The Registrar will record all credit granted as "Px" (Passed by Examination) on the transcript. No honor points will be awarded and the credit by examination will not be included in the cumulative grade point average (CGPA).

CREDIT BY WAIVER

Some courses and series of courses have been identified which may be waived in meeting program graduation requirements.

Students requesting advanced standing Credit by Waiver must: Complete an Application for Credit by Waiver or Examination and submit the application for evaluation to the department granting the waiver.

Upon completion of the evaluation, submit the application and evaluation to the Campus Registrar for recording on their transcript.

The following entry will be made on the student's transcript for all course credit granted by waiver: "The following program requirements were waived by substituting previous education and/or occupational experience. (list courses waived.) This waiver of program requirements was granted this date _____ by _____ (evaluator) and is in accordance with Department, Campus and Area policies, rules and regulations."

No fee will be charged for advanced credit by waiver.

Credit by Waiver will not be included in calculating student's grade point average (CGPA).

Credit granted by waiver is subject to evaluation by other departments, programs and other institutions and probably would not be accepted as transfer credit by them.

Credit granted by waiver will be contingent upon satisfactory completion of advanced courses.

ADVANCED PLACEMENT CREDIT

Southeast Community College
Lincoln Campus

Advanced placement in the Welding Technology Program of the Lincoln Campus of Southeast Community College will be determined on the basis of competencies which the prospective student demonstrates according to the following:

Students Demonstrating Competency No.	Will Receive SCC Credit In the amount of	For SCC Course No.	Course Title
1	0		
2	1	6614	Oxy-acetylene (Welding)
3	1	6614	Oxy-acetylene (Welding)
4	1	6614	Oxy-acetylene (Welding)
5	1	6614	Oxy-acetylene (Welding)
6	1	6614	Oxy-acetylene (Welding)
7	1	6606	SMAW (Welding) Flat
8	1	6606	SMAW (Welding) Flat
9	1	6606	SMAW (Welding) Flat
10-11	3	6607	SMAW (Welding) Horz. & Vert.
12-13	2	6627	GMAW (Welding) Flat & Horz.
14	1	6635	GMAW (Welding) Advanced
15	1	6622	Equipment (GTAW)
16-20	1	6626	GTAW (Welding) SS & Al

The program supervisor of the Welding Technology Program has the responsibility for conducting and evaluating examinations to determine the competency level of students requesting consideration under this agreement.

Examinations used for evaluation purposes will be updated from time to time although every effort will be made to maintain their consistency with the competencies identified in this agreement.

This agreement cannot, however, be considered a contract between Southeast Community College-Lincoln Campus and any prospective student. The Board of Governors of the College reserves the right to make changes in courses required, courses offered, credits waived, credits granted, and in any other matters it deems necessary without revision of this agreement and without notice. Prospective students wishing consideration under this agreement should contact the program supervisor in order to establish and maintain a close working relationship between the College, its program, and the student.

ADVANCED PLACEMENT CREDIT

Southeast Community College
Milford Campus

Advanced placement in the Welding Technology Program of the Milford Campus of Southeast Community College will be determined on the basis of competencies which the prospective student demonstrates according to the following:

Students Demonstrating Competency No.	Will Receive SCC Credit In the Amount of	For SCC Course No.	Course Title
1	½	5400130	Oxy-acetylene Cutting
2,3	1	5400120	Oxy-acetylene Welding I
4,5,6	3	5400228	Oxy-acetylene Welding II
7,8,9	3	5400124	Arc Welding (Stick-electrode) I
10,11	3	5400232	Arc Welding (Stick-electrode) II
12,13,14	3	5400438	Semi & Automatic Welding Machines I
15,16,17,18,19,20	1	5400327	Gas Tungsten

The program supervisor of the Welding Technology Program has the responsibility for conducting and evaluating examinations to determine the competency level of students requesting consideration under this agreement.

Examinations used for evaluation purposes will be updated from time to time although every effort will be made to maintain their consistency with the competencies identified in this agreement.

This agreement cannot, however, be considered a contract between Southeast Community College-Milford Campus and any prospective student. The Board of Governors of the College reserves the right to make changes in courses required, courses offered, credits waived, credits granted, and in any other matter it deems necessary without revision of this agreement and without notice. Prospective students wishing consideration under this agreement should contact the program supervisor in order to establish and maintain a close working relationship between the College, its program, and the student.

HIGH SCHOOL CREDIT

High school credits are suggested for each competency. It is the responsibility of each educational agency to determine the level of competency and the amount of credit to be awarded.

Competency	Semester Credit Hours
No. 1 through No. 6	2
No. 7 through No. 11	3
No. 12 through No. 14	2
No. 15 through No. 20	3



Competencies

A competency consists of three sections or parts that combine to provide a detailed outline of a major task that a student must accomplish to reach one or more previously stated student outcomes. Competencies are described as follows:

- a. Task — What the student must do to demonstrate an ability to do the job.
- b. Conditions or Limitations — A description of the circumstances under which the student will demonstrate the skill. Usually included are:
 1. time allowance;
 2. tolerances allowed;
 3. references which may be used;
 4. specific tools and materials to be used (common tool lists are generally omitted unless a required usage is to be demonstrated);
 5. work location (if other than school site);
 6. and, other limitations unique to the task.
- c. Criteria of Acceptable Performance — Standards described that constitute acceptable performance. These standards must:
 1. be compatible with the task and the condition;
 2. evaluate all components of the conditions;
 3. include the percentage of responses that must be correct if the competency is primarily cognitive;
 4. and, specify the standard for the criteria. This may take the form of a list of criteria, an instructor's checklist, or references to an authoritative manual such as an automotive flat-rate manual.

Represented in the guide are those competencies needed for initial employment. They are not designated or described by grade level. A student must complete all the competencies available at a school learning capabilities and time permit.

TASK:

To cut a flat piece of mild steel with a hand-held oxy-acetylene cutting torch.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including an oxy-acetylene welding and cutting unit with a Purox No. 5 [or equivalent] cutting tip in torch) and one piece of $\frac{1}{4}$ " x 4" x 10" flat mild steel, the student will cut the material into four pieces $\frac{1}{4}$ " x $2\frac{1}{2}$ " x 4". All work is to be done without reference materials and within a 15 minute time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Verbally identify and describe the use of given tools and equipment.
2. Set up a cutting station that meets safety precautions. (Note: Safety precautions which will be considered acceptable are those listed in the chapter "General Precautions in Welding and Cutting Work" from the book *The Oxy-acetylene Handbook*, Union Carbide Corporation-Linde Division, second edition.)
3. Light and adjust the cutting torch using the operating steps found in the lessons on (a) Adjust Cutting Assembly and (b) Cutting. (Note: Lessons can be found in *Smith's Instructor's Manual for a Basic Course - Oxy-acetylene, Brazing, Cutting and Welding*.)
4. Cut the given piece of metal into four straight rectangular pieces $\frac{1}{4}$ " x $2\frac{1}{2}$ " x 4", (plus or minus $\frac{1}{4}$ " of the desired size) without slag attached and with the cut edge exhibiting correct lag and drag.
5. Shut off torch and leave the equipment in acceptable storage condition. (Check the reference listed in No. 2 above.)
6. Complete all work according to specifications and in a safe manner.
7. Complete the cutting assignment within the time limit.
8. Return the equipment to acceptable storage and working condition.

TASK:

To fusion weld mild steel in a flat position using the oxy-acetylene process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including an oxy-acetylene welding unit equipped with Purox No. 6 [or equivalent] welding tip), 24 pieces of 16 gauge 4"x 6" mild steel metal and 1/16" mild steel filler rod, the student will weld on the 6" side three each of butt joints, lap joints, and open corner joints and will subject them to a "U" bend. The student will also weld and visually inspect three "T" joints. All work is to be done without reference material and within a 2½ hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up a welding station that meets safety precautions and operating conditions according to the steps listed in *Smith's Instructor's Manual for a Basic Course - Oxy-acetylene, Brazing, Cutting and Welding*, Lesson II, "Set up Equipment."
2. Light and adjust torch and flame as presented in Lesson III, "Adjust Torch and Flame" from the above reference.
3. Weld the joints in flat position as described in Lesson VI, "Flat Butt Weld-With Rod-Light Material"; Lesson VII, "Flat Lap Weld-Light Materials"; Lesson VIII, "Fillet Weld, Flat Position" from the above reference.
 - a. The butt joint and lap joint must withstand the "U" bend test without breaking or showing visible defects.
 - b. The "T" weld joint and open corner joint will exhibit visual inspection profiles as discussed in American Welding Society (A.W.S.) D 1.1 - 75, Section 3.6.
4. Complete all work according to specifications and in a safe manner.
5. Complete the tasks within the time limit.
6. Return the equipment to acceptable storage and working conditions.

TASK:

To fusion weld mild steel in a horizontal position using the oxy-acetylene process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including an oxy-acetylene welding unit equipped with Purox No. 9 [or equivalent] welding tip), 24 pieces of 1/8" x 4" x 6" mild steel metal and 3/32" mild steel filler rod, the student will weld on the 6" side three each of butt joints, lap joints, and open corner joints and will subject them to a "U" bend. The student will also weld and visually inspect three "T" joints. All work is to be done without reference material and within a 2½ hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up a welding station that meets safety precautions and operating conditions according to the steps listed in *Smith's Instructor's Manual for a Basic Course - Oxy-acetylene, Brazing, Cutting and Welding*, Lesson II, "Set up Equipment."
2. Light and adjust torch and flame as presented in Lesson III, "Adjust Torch and Flame" from the above reference.
3. Weld the joints in horizontal position as described in the chapter "Fusion Welding Mild Steel Plate" from the book *The Oxy-acetylene Handbook*, Union Carbide Corporation-Linde Division, second edition.
 - a. The butt joint and lap joint must withstand the "U" bend test without breaking or showing visible defects.
 - b. The "T" weld joint and open corner joint will exhibit visual inspection profiles as discussed in American Welding Society (A.W.S.) D 1.1 - 75, Section 3.6.
4. Complete all work according to specifications and in a safe manner.
5. Complete the tasks within the time limit.
6. Return the equipment to acceptable storage and working conditions.

TASK:

To fusion weld mild steel in a vertical position using the oxy-acetylene process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including an oxy-acetylene welding unit equipped with Purox No. 9 [or equivalent] welding tip), 24 pieces of 1/8" x 4" x 6" mild steel metal and 1/8" mild steel filler rod, the student will weld on the 6" side three each of butt joints, lap joints, and open corner joints and will subject them to a "U" bend. The student will also weld and visually inspect three "T" joints. All work is to be done without reference material and within a 2½ hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up a welding station that meets safety precautions and operating conditions according to the steps listed in *Smith's Instructor's Manual for a Basic Course - Oxy-acetylene, Brazing, Cutting and Welding*, Lesson II, "Set up Equipment."
2. Light and adjust torch and flame as presented in Lesson III, "Adjust Torch and Flame" from the above reference.
3. Weld the joints in vertical position as described in the chapter "Fusion Welding Mild Steel Plate" from the book *The Oxy-acetylene Handbook*, Union Carbide Corporation-Linde Division, second edition.
 - a. The butt joint and lap joint must withstand the "U" bend test without breaking or showing visible defects.
 - b. The "T" weld joint and open corner joint will exhibit visual inspection profiles as discussed in American Welding Society (A.W.S.) D 1.1 - 75, Section 3.6.
4. Complete all work according to specifications and in a safe manner.
5. Complete the tasks within the time limit.
6. Return the equipment to acceptable storage and working conditions.

TASK:

To fusion weld mild steel in an overhead position using the oxy-acetylene process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including an oxy-acetylene welding unit equipped with Purox No. 9 [or equivalent] welding tip), 24 pieces of 1/8" x 4" x 6" mild steel metal and 1/8" mild steel filler rod, the student will weld on the 6" side three each of butt joints, lap joints, and open corner joints and will subject them to a "U" bend. The student will also weld and visually inspect three "T" joints. All work is to be done without reference material and within a 2½ hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up a welding station that meets safety precautions and operating conditions according to the steps listed in *Smith's Instructor's Manual for a Basic Course - Oxy-acetylene, Brazing, Cutting and Welding*, Lesson II, "Set up Equipment."
2. Light and adjust torch and flame as presented in Lesson III, "Adjust Torch and Flame" from the above reference.
3. Weld the joints in an overhead position as described in the chapter "Fusion Welding Mild Steel Plate" from the book *The Oxy-acetylene Handbook*, Union Carbide Corporation-Linde Division, second edition.
 - a. The butt joint and lap joint must withstand the "U" bend test without breaking or showing visible defects.
 - b. The "T" weld joint and open corner joint will exhibit visual inspection profiles as discussed in A.W.S. D1.1 - 75, Section 3.6.
4. Complete all work according to specifications and in a safe manner.
5. Complete the tasks within the time limit.
6. Return the equipment to acceptable storage and working conditions.

TASK:

To braze weld mild steel in a flat and horizontal position using the oxy-acetylene process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including an oxy-acetylene welding unit equipped with Purox No. 6 [or equivalent] welding tip), 36 pieces of 16 gauge x 4" x 6" mild steel metal and 3/32" bronze filler rod, the student will weld on the 6" side three each of butt joints, lap joints, and "T" joints in each position (flat and horizontal). The butt joints and lap joints will be subjected to a "U" bend. The "T" weld will be subjected to visual inspection. All work is to be done without reference material and within a 3 hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up a welding station that meets safety precautions and operating conditions according to the steps listed in *Smith's Instructor's Manual for a Basic Course - Oxy-acetylene, Brazing, Cutting and Welding*, Lesson II, "Set up Equipment."
2. Light and adjust the torch and flame as presented in Lesson III, "Adjust Torch and Flame" from the above reference.
3. Weld joints in the flat position as described in Lesson XVI, "Braze Butt Joint"; Lesson XVII, "Braze Weld Lap Joint"; and Lesson XVIII, "Fillet Weld with Bronze - Flat Position" of *Smith's Instructor's Manual for a Basic Course - Oxy-acetylene, Brazing, Cutting and Welding*; and in the horizontal position as described in the chapter "Fusion Welding Mild Steel Plate" from *The Oxy-Acetylene Handbook*, Union Carbide Corporation-Linde Division, second edition, except that the welding technique used should be similar to the one mentioned while braze welding rather than fusion welding. Only position information should be used from the chapter on fusion welding.
 - a. The butt weld and the lap weld must withstand the "U" bend test without breaking or showing visible defects.
 - b. The "T" weld joint will exhibit visual inspection profiles as discussed in A.W.S., D1.1 - 75, Section 3.6.
4. Complete all work according to specifications and in a safe manner.
5. Complete the tasks within the time limit.
6. Return the equipment to acceptable storage and working conditions.

TASK:

To fusion weld continuous and parallel stringer beads using the shielded metal arc welding process.

CONDITIONS AND LIMITATIONS:**A. Flat Position**

Given the proper tools and equipment (including ac/dc arc welding equipment), a $\frac{3}{8}$ " x 4" x 6" plate of carbon steel and E6013 electrodes, $\frac{5}{32}$ " in diameter, the student will run parallel and continuous stringer beads in the flat position, $\frac{3}{4}$ " apart for the 6" length of the plate. All work is to be done without reference materials and within a 30 minute time limit.

B. Horizontal Position

Given the proper tools and equipment (including ac/dc arc welding equipment), a $\frac{1}{4}$ " x 4" x 6" plate of carbon steel and E6011 electrodes, $\frac{1}{8}$ " in diameter, the student will run parallel and continuous stringer beads in the horizontal position, $\frac{3}{4}$ " apart for the 6" length of the plate. All work is to be done without reference materials and within a 30 minute time limit.

C. Vertical Up Position

Given the proper tools and equipment (including ac/dc arc welding equipment), a $\frac{1}{2}$ " x 4" x 6" plate of carbon steel and E7018 electrodes, $\frac{1}{8}$ " in diameter, the student will run parallel and continuous stringer beads in the vertical up position, $\frac{3}{4}$ " apart for the 6" length of the plate. All work is to be done without reference materials and within a 30 minute time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

For each of the given conditions, the student will:

1. Set up the welding station according to the *Hobart Pocket Welding Guide, Safety Precautions*.
2. Prepare the plate by the layout of lines with soapstone, $\frac{3}{4}$ " apart for the length of the plate, $\frac{1}{2}$ " off the edge of the plate.
3. Adjust the welding machine to the correct polarity setting according to the electrode specifications as stated in the *Hobart Pocket Welding Guide*.
4. Strike an arc and run a continuous bead using the full length of the electrode.
 - a. The beads shall meet the specifications of A.W.S., D 1.1 - 75, Section 3.6 for bead profiles.
5. Complete all work within the time limit.
6. Complete all work according to specifications and in a safe manner.
7. Return the equipment to acceptable storage and working condition.

TASK:

To fusion weld in a flat position a multiple-pass build-up using the shielded metal arc welding process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including ac/dc arc welding equipment), a ½" x 3" x 3" mild steel plate and E6013 electrodes 4/32" in diameter, the student will build up the plate to a total height of 1½" using multiple pass build-up welding techniques in the flat position. When the weld is completed the plate steel should have a machinability rating that compares favorably with cold drawn bar steel. All work is to be done without reference material and within a 1 hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up the welding station according to the *Hobart Pocket Welding Guide, Safety Precautions*.
2. Clean the slag from the first bead, run another bead parallel to the first and continue this process for the width of the metal.
 - a. The beads will be checked for uniformity, slag pockets, and inclusions.
 - b. Each layer of beads will run at right angles to the previous layers of beads until a 1" build-up is obtained.
 - c. The pad will be cooled slowly (covered with sand is the most acceptable method).
 - d. The beads on the surface will have a smooth finish, minor valleys or depressions between the beads.
 - e. Each layer of the beads will be fused with no slag inclusions or holes between the beads.
3. Complete all work within the time limit.
4. Complete all work according to specifications and in a safe manner.
5. Return the equipment to acceptable storage and working condition.

TASK:

To fusion weld mild steel in a flat position using the shielded metal arc welding process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including ac/dc arc welder), E7024 electrodes, 1/8" in diameter, and 16 plates of mild steel 1/4" x 2" x 6", the student will tack-weld and weld two each of open corner, "T" lap and butt joints in the flat position. Joints are to be formed using the 6" side of the metal and running the 6" long beads by breaking and re-starting at the midpoint of the weld beads. Joints will be subjected to visual and destructive tests. All work is to be done without reference materials and within a 1 1/2 hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up the welding station according to the *Hobart Pocket Welding Guide, Safety Precautions*.
2. Prepare the plates for each of the joints by tack welding them into position according to specifications of the American Welding Society for tack welds.
3. Run the 6" long beads, breaking and restarting at the midpoint of the weld beads.
 - a. The beads will meet the specifications of A.W.S., D 1.1 - 75, Section 3.6.
 - b. All joints will be visually inspected according to A.W.S., D 1.1 - 75, Section 3.6 and the "T" joint will be destructive tested according to A.W.S., D 1.1 - 75, Section 5.48, Part E.
4. Complete all work within the time limit.
5. Complete all work according to specifications and in a safe manner.
6. Return the equipment to acceptable storage and working condition.

TASK:

To fusion weld mild steel in a horizontal position using the shielded metal arc welding process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including ac/dc arc welder), E6011 electrodes, 1/8" in diameter, and 12 plates of 1/4" x 2" x 6" mild steel, the student will tack-weld and weld two each of open corner, "T" and lap joints in the horizontal position using the 6" side of the metal. Joints will be subjected to visual and destructive tests. All work is to be done without reference materials and within a 1½ hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up the welding station according to the *Hobart Pocket Welding Guide, Safety Precautions*
2. Prepare the plates for each of the joints. The plates are to be tack welded in position according to the specifications of the American Welding Society for tack welds.
 - a. The beads will meet the specifications of A.W.S., D 1.1 - 75, Section 3.6.
 - b. All joints will be visually inspected according to A.W.S., D 1.1 - 75, Section 3.6 and the "T" joint will be destructive tested according to A.W.S., D 1.1 - 75, Section 5.48, Part E.
3. Complete all work within the time limit.
4. Complete all work according to specifications and in a safe manner.
5. Return the equipment to acceptable storage and working condition.

TASK:

To fusion weld mild steel in a vertical-down position using the shielded metal arc welding process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including ac/dc arc welder), E6013 electrodes, 1/8" in diameter, and 12 plates of 1/4" x 2" x 6" mild steel, the student will tack-weld and weld two each of open corner, "T" and lap joints in the vertical-down position. Joints are to be formed using the 6" side of the metal. Joints will be subjected to visual and destructive tests. All work is to be done without reference materials and within a 1½ hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up the welding station according to the *Hobart Pocket Welding Guide, Safety Precautions*.
2. Prepare the plates for each of the joints. The plates are to be tack welded in position according to specifications of the American Welding Society for tack welds.
 - a. The beads will meet the specifications of A.W.S., D 1.1 - 75, Section 3.6.
 - b. All joints will be visually inspected according to A.W.S., D 1.1 - 75, Section 3.6 and the "T" joint will be destructive tested according to A.W.S., D 1.1 - 75, Section 5.48, Part E.
3. Complete all work within the time limit.
4. Complete all work according to specifications and in a safe manner.
5. Return the equipment to acceptable storage and working condition.

TASK:

To fusion weld mild steel in a flat position using the gas metal arc welding process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including a G.M.A.W. constant potential power supply, welding grade CO₂ shielding gas, wire feeder, air-cooled gun for short arc application, using .035 wire) and 16 pieces of 1/8" x 2" x 6" mild steel, the student will tack-weld and weld two each of the following joints on the 6" side of the metal: outside corner, lap, "T", and square groove butt with 1/8" root gap. All weld joints are to be subjected to visual inspection according to A.W.S. and the "T" joints will also be subjected to destructive break tests according to A.W.S. The student may use as reference *Hobart-Micro-Wire Welding*, E.W.-300. All work is to be completed within a 1 hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up the equipment for the gas metal arc welding process according to the operating steps in the instructional manual for the power source.
2. Adjust the welder according to *Hobart-Micro-Wire Welding*, EW300, section on Welding Condition - Tables.
3. Position and tack weld the plates.
 - a. All welds will meet A.W.S., D1.1 - 75, Sections 3.6.2 and 3.6.1 specifications for weld profiles.
 - b. The "T" joint break test will meet A.W.S., D1.1 - 75, Sections 5.28.2.1 and 5.28.2.2 specifications.
4. Complete all work within the time limit.
5. Complete all work in a safe manner and according to A.W.S., ANSI-Z49.1, *Safety in Welding and Cutting*.
6. Return the equipment to acceptable storage and working condition.

TASK:

To fusion weld mild steel in a horizontal position using the gas metal arc welding process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including a G.M.A.W. constant potential power supply, welding grade CO₂ shielding gas, wire feeder, air-cooled gun for short arc application, using .035 wire) and 16 pieces of 1/8" x 2" x 6" mild steel, the student will tack-weld and weld two each of the following joints on the 6" side of the metal: outside corner, lap, "T", and square groove butt with 1/8" root gap. All weld joints are to be subjected to visual inspection according to A.W.S. and the "T" joints will also be subjected to destructive break tests according to A.W.S. The student may use as reference *Hobart-Micro-Wire Welding*, EW-300. All work is to be completed within a 1 hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up the equipment for the gas metal arc welding process according to the operating steps in the instructional manual for the power source.
2. Adjust the welder according to *Hobart-Micro-Wire Welding*, EW300, section on Welding Condition — Tables.
3. Position and tack weld the plates.
 - a. All welds will meet A.W.S., D1.1 - 75, Section 3.6.2 and 3.6.1 specifications for weld profiles.
 - b. The "T" joint break test will meet A.W.S., D1.1 - 75, Sections 5.28.2.1 and 5.28.2.2 specifications.
4. Complete all work within time limit.
5. Complete all work according to A.W.S., ANSI-Z49.1, *Safety in Welding and Cutting*.
6. Return the equipment to acceptable storage and working conditions.

TASK:

To fusion weld mild steel in a flat position using the gas metal arc welding process with the spray transfer technique.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including a G.M.A.W. constant potential power supply, 95% argon, 5% oxygen shielding gas, wire feeder, air cooled gun for spray arc application, using .045 diameter filler wire), four pieces of 3/8" x 3" x 6" and two pieces of 3/8" x 2" x 7" mild steel plates, the student will tack-weld and weld two beveled butt joints with a back up strip on the 6" side of the metal. Both joints will be visually inspected according to A.W.S. guidelines and subjected to A.W.S. destructive break tests. Reference materials may be used and all work is to be completed within a 1 hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will

1. Set up equipment for the gas metal arc welding process according to the operating steps in the instructional manual for the power source.
2. Adjust the welder according to Chapter 12 of the *Welding Power Handbook* of the A.W.S. and Table Six in the Appendix "Approximate Spray Arc Transition Currents."
3. Position and tack weld the plates.
 - a. All welds must meet the standards of the A.W.S. D1.1-75 Sections 3.6 and 2.13.
 - b. The destructive tests shall comply to A.W.S. D 1.1 - 75 Sections 5.19 and 5.27.
4. Complete all work in a safe manner complying to the latest edition of A.W.S. ANSI-Z49.1 - *Safety In Welding and Cutting*.
5. Complete the assignment within the time limit.
6. Return the equipment to acceptable storage and working condition.

TASK:

To weld beads on aluminum plate in a flat position using the gas tungsten arc welding process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including an A.C. transformer power source with superimposed high frequency current, a welding torch equipped with 5/32" diameter tungsten electrode, argon gas, degreasing solvent, stainless steel wire brush and necessary accessories), two 1/4" x 6" x 12" 5083 (or other 5000 Series) aluminum plates, and 3/16" filler rod (choice of 5183, 5556 or 5356), the student will run four 12" long beads one inch apart on each plate (a total of 8 beads 12 inches long). The *Aluminum Welder's Training Manual and Exercises Book* by the Aluminum Association may be used for reference and the task is to be completed within a 1 hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up the welding station according to Exercise 1, "Setting Up the Equipment for T.I.G. Welding Aluminum," *Aluminum Welder's Training Manual and Exercises* by the Aluminum Association.
2. Clean the surfaces on which weld metal will be deposited by wiping the area with a cloth dipped in a degreasing solvent of alcohol, acetone or chloroethene completely removing any oil or grease.
3. Thoroughly brush the surfaces with a stainless steel wire brush removing all surface aluminum oxide where the weld beads will be placed.
4. Clean and degrease the filler rod with stainless steel wool for removing surface oxides and solvent for removing the oil.
5. Regulate the argon gas flow between 30 - 35 C.F.H.
6. Select welding current between 200 - 250 amperes.
7. Strike the arc, form a weld pool and make eight 12" long beads, four on each plate, with proper bead width, toe lines, ripple formation, bead contour and penetration meeting the standards set forth by the Aluminum Association's Exercise 3 of *Aluminum Welder's Training Manual and Exercises*.
8. Complete all work within the time limit.
9. Complete all work according to specifications and in a safe manner.
10. Return the equipment to acceptable storage and working condition.

TASK:

To make flat position single pass fillet welds on aluminum sheet using the gas tungsten arc welding process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including an A.C. transformer power source with superimposed high frequency current, a welding torch equipped with 3/32" diameter tungsten electrode, argon gas, stainless steel wire brush and necessary accessories), six 1/8" x 6" x 6" 5083 (or other 5000 series) aluminum sheets, 1/8" filler rod (choice of 5183, 5556, or 5356), and cleaning solution or solvent, the student will tack-weld and run three 6" long "T" fillet beads, breaking and restarting at the mid-point of the beads, using the six plates. Joints will be subjected to destructive testing. The *Aluminum Welder's Training Manual and Exercises Book* by the Aluminum Association may be used for reference and the task is to be completed with a 1 hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up the welding station according to Exercise 1, "Setting Up the Equipment for T.I.G. Welding Aluminum," *Aluminum Welder's Training Manual and Exercises* by the Aluminum Association.
2. Clean the surfaces on which weld metal will be deposited by wiping the area with a cloth dipped in a degreasing solution of alcohol, acetone or chloroethene completely removing any oil or grease.
3. Thoroughly brush the surfaces with stainless steel wire brush removing all surface aluminum oxide where the weld bead will be placed.
4. Clean and degrease the filler rod with stainless steel wool for removing surface oxides and solvent for removing the oil.
5. Regulate the argon flow rate at 20 C.F.H.
6. Select welding current between 125 - 160 amperes.
7. Tack weld the two sheets on each end according to the position for flat welding indicated in Exercise 4, "Flat Position Single Pass Fillet Welds," *Aluminum Welder's Training Manual and Exercises*.
8. Strike the arc, form a weld pool, run the 6 inch long beads breaking and restarting at the midpoint of the weld bead producing the proper bead width, toe lines, ripple formation, bead contour and penetration to meet the standards set forth by the Aluminum Association Exercise 4 of *Aluminum Welder's Training Manual and Exercises*.
9. Prepare and free-bend test the "T" joints according to standard testing procedures of the Aluminum Association's Exercise 4, *Aluminum Welder's Training Manual and Exercises*.
10. Complete all work within the time limit.
11. Complete all work according to specifications and a safe manner.
12. Return the equipment to acceptable storage and working condition.

TASK:

To make flat position single pass butt welds on aluminum sheet using the gas tungsten arc welding process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including an A.C. transformer power source with superimposed high frequency current, a welding torch equipped with 1/8" diameter tungsten electrode; argon gas, stainless steel wire brush and necessary accessories), six 3/16" x 6" x 12" 5083 (or other 5000 series) aluminum sheets, and 1/8" filler rod (choice of 5183, 5556 or 5356), cleaning solution or solvent, bend test fixture, and caustic solution, the student will bevel abutting edges and run three "V" groove butt joints 12" long. Joints will be subjected to visual and destructive testing. The *Aluminum Welder's Training Manual and Exercises Book* by the Aluminum Association may be used for reference and the task is to be completed within a 2 hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up the welding station according to Exercise 1, "Setting Up the Equipment for T.I.G. Welding Aluminum," *Aluminum Welder's Training Manual and Exercises*.
2. Bevel abutting edges of the sheet as indicated in joint design Exercise 5, "Flat Position Single Pass Butt Welds in Aluminum Sheet," *Aluminum Welder's Training Manual and Exercises*.
3. Clean all surfaces, including back up plate, where weld metal will be deposited by wiping the area with a cloth dipped in a degreasing solution of alcohol, acetone or chlorethene completely removing any oil or grease.
4. Thoroughly brush the surfaces with stainless steel wire brush removing all surface aluminum oxide where the weld bead will be placed.
5. Clean and degrease the filler rod with stainless steel wool for removing surface oxides and solvent for removing the oil.
6. Regulate the argon flow rate at 25 C.F.H.
7. Select welding current between 175 - 210 amperes.
8. Arrange the weld joint with 1/8" to 3/16" root opening without jigs. Support and level the position section and backup plate with all units. Tack weld as illustrated in Exercise 5, "Flat Position Single Pass Butt Welds in Aluminum Sheets," of *Aluminum Welder's Training Manual and Exercises*.
9. Strike the arc, form a weld pool, run the three 12" long beads the full length of the weld joint producing the proper bead width, reinforcement, toe lines, ripple formation, bead contour and penetration to meet the standard set forth by the Aluminum Association Exercise 5 and 3 of *Aluminum Welder's Training Manual and Exercises*.
10. Prepare and free bend test, section and acid-etch, and nick break test the butt joints according to standards and procedures of the Aluminum Association Exercise 5 of *Aluminum Welder's Training Manual and Exercises*.
11. Complete all work within the time limit.
12. Complete all work according to specifications and in a safe manner.
13. Return the equipment to acceptable storage and working condition.

TASK:

To make flat position multi-pass fillet welds on aluminum plate using the gas tungsten arc welding process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including an A.C. transformer power source with superimposed high frequency current, a welding torch equipped with $\frac{1}{4}$ " diameter tungsten electrode, argon gas, stainless steel wire brush and necessary accessories), four $\frac{1}{2}$ " x 6" x 6" 5083 (or other 5000 series) aluminum plates and $\frac{1}{4}$ " filler rod (choice of 5183, 5556 or 5356), cleaning solution or solvent, and caustic solution, the student will tack-weld and run two 12" long "T" fillet joints breaking and restarting at the mid-point of the joints. Joints will be subjected to visual inspection. The *Aluminum Welder's Training Manual and Exercises Book* by the Aluminum Association may be used for reference and the task is to be completed with a 2 hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up the welding station according to Exercise 1, "Setting Up the Equipment for T.I.G. Welding Aluminum," *Aluminum Welder's Training Manual and Exercises*.
2. Clean the surfaces on which weld metal will be deposited by wiping the area with a cloth dipped in a degreasing solution of alcohol, acetone, or chloroethene completely removing any oil or grease.
3. Thoroughly brush the surfaces with stainless steel wire brush removing all surface aluminum oxide where the weld bead will be placed, and brush between the passes.
4. Clean and degrease the filler rod with stainless steel wool for removing surface oxides and solvent for removing the oil.
5. Regulate the argon flow at 35 C.F.H.
6. Select welding current between 375 - 450 amperes.
7. Tack weld the two plates on each end. (Position for flat welding as indicated in Exercise 6, "Flat Position Multi-Pass Fillet Welds in Plate," *Aluminum Welder's Training Manual and Exercises*.)
8. Strike the arc, form a pool, run the two 6" long joints the full length of the weld joint breaking and restarting at the midpoint of each weld bead and following the proper pass sequence, producing the proper bead width, toe lines, ripple formation, bead contour, and penetration to meet the standards set forth by the Aluminum Association Exercise 6 of *Aluminum Welder's Training Manual and Exercises*.
9. Prepare and acid etch the "T" joints according to standard test procedures of the Aluminum Association's Exercise 5, *Aluminum Welder's Training Manual and Exercises*.
10. Complete all work within the time limit.
11. Complete all work according to specifications and in a safe manner.
12. Return the equipment to acceptable storage and working condition.

TASK:

To make flat position multi-pass butt welds on aluminum plate using the gas tungsten arc welding process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including an A.C. transformer power source with superimposed high frequency current, a welding torch equipped with 1/4" diameter tungsten electrode, argon gas, stainless steel wire brush and accessories), four 1/2" x 6" x 12" 5083 (or other 5000 series) aluminum plates and 1/4" filler rod (choice of 5183, 5556 or 5356), aluminum, copper, or steel back-up bar, cleaning solution or solvent, bend test fixture and caustic solution, the student will bevel abutting edges, tack-weld and run two 12" long "V" groove butt joints using the four plates. Joints will be subjected to visual and destructive testing. The *Aluminum Welder's Training Manual and Exercises Book* by the Aluminum Association may be used for reference and the task is to be completed with a 2 hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up the welding station according to Exercise 1, "Setting Up the Equipment for T.I.G. Welding Aluminum," *Aluminum Welder's Training Manual Exercises* by the Aluminum Association.
2. Bevel the edges of the plate to the correct degree as indicated in the joint design Exercise 8, "Flat Position Multi-Pass Butt Welds in Aluminum Plate," *Aluminum Welder's Training Manual Exercises*.
3. Clean all surfaces, including back up plate, where weld metal will be deposited by wiping the area with a cloth dipped in a degreasing solution of alcohol, acetone or chloroethene completely removing any oil or grease.
4. Thoroughly brush the surfaces with stainless steel wire brush removing all surface aluminum oxides where the weld bead will be placed, and brush between the passes.
5. Clean and degrease the filler rod with stainless steel wool for removing surface oxides and solvent for removing the oil.
6. Regulate the argon flow rate between 35 - 40 C.F.H.
7. Select welding current between 375 - 450 amperes.
8. Arrange the weld joints with 0 inches to 3/16 inch root opening with jigs; put into position, and use section and back up plate with all units supported and leveled and tack weld as illustrated in Exercise 8 of *Aluminum Welder's Training Manual and Exercises*.
9. Strike the arc, form a weld pool, run the two 12" joints the full length of the weld joint and following the proper pass sequence, producing the proper bead width, reinforcement, toe lines, ripple formation, bead contour and penetration to meet the standards set forth by the Aluminum Association Exercises 3 and 8 of the *Aluminum Welder's Training Manual and Exercises*.
10. Prepare and free bend test, section and acid etch, and nick break test the butt joints according to the standards and procedures of the Aluminum Association Exercise 5 of *Aluminum Welder's Training Manual and Exercises*.
11. Complete all work within the time limit.
12. Complete all work according to specifications and in a safe manner.
13. Return the equipment to acceptable storage and working condition.

TASK:

To make horizontal multi-pass welds on aluminum plate using the gas tungsten arc welding process.

CONDITIONS AND LIMITATIONS:

Given the proper tools and equipment (including an A.C. transformer power source with superimposed high frequency current, a welding torch equipped with 3/16 diameter tungsten electrode, argon gas, stainless steel wire brush and necessary accessories), four 1/2" x 6" x 12" 5083 (or other 5000 series) aluminum plates and 3/16" filler rod (choice of 5183, 5556 or 5356), cleaning solution or solvent, and caustic solution, the student will tack-weld and run two 12" long "T" fillet joints breaking and restarting at mid-point of the joints. Joints will be subjected to visual inspection. The *Aluminum Welder's Training Manual and Exercises Book* by the Aluminum Association may be used for reference and the task is to be completed within a 2 hour time limit.

CRITERIA OF ACCEPTABLE PERFORMANCE:

The student will:

1. Set up the welding station according to Exercise 1, "Setting Up the Equipment for T.I.G. Welding Aluminum," *Aluminum Welder's Training Manual and Exercises*.
2. Clean the surfaces on which weld metal will be deposited by wiping the area with a cloth dipped in a degreasing solution of alcohol, acetone or chloroethene completely removing any oil or grease.
3. Thoroughly brush the surfaces with stainless steel wire brush removing all surface aluminum oxide where the weld bead will be placed and brush between passes.
4. Clean and degrease the filler rod with stainless steel wool for removing surface oxides and solvent for removing the oil.
5. Regulate the argon flow at 35 C.F.H.
6. Select welding current between 250 - 320 amperes.
7. Tack weld the two plates on each end. (Position for horizontal welding as indicated in Exercise 9, "Horizontal Position Multi-Pass Fillet," *Aluminum Welder's Training Manual and Exercises*.)
8. Strike the arc, form a pool, run two 12" long joints the full length of the weld joint breaking and restarting at the midpoint of each weld bead and following the proper pass sequence, producing the proper bead width, toe lines, ripple formation, bead contour, and penetration to meet the standards set forth by the Aluminum Association Exercise 9 of *Aluminum Welder's Training Manual and Exercises*.
9. Prepare and acid etch the "T" joints according to standard test procedures of the Aluminum Association's Exercise 5, *Aluminum Welder's Training Manual and Exercises*.
10. Complete all work within the time limit.
11. Complete all work according to specifications and in a safe manner.
12. Return the equipment to acceptable storage and working condition.



Enabling Tasks

The enabling tasks are the activities necessary for developing a job skill. The completion of all enabling tasks for a competency leads to achievement of that competency. They may become daily or weekly lesson plans if teachers develop conditions and criteria similar to those developed for the competencies. The enabling tasks have been suggested by people in business and industry.

COMPETENCY NO. 1 THROUGH COMPETENCY NO. 6

GENERAL TASKS:

- Assemble equipment
- Turn on torch
- Adjust torch to neutral flame
- Turn off torch
- Test for leaks
- Clean orifice
- Measure orifice size
- Select cylinders using color code method
- Adjust regulators according to size of tip orifice
- Select material for job
- Interpret blueprints and shop drawings
- Release pressure on regulators
- Drain hoses
- Practice safe welding procedures according to A.W.S. ANSI-Z49.1 *Safety in Welding and Cutting*
- Replace worn or broken parts
- Select proper tip size

COMPETENCY NO. 1 – TO CUT A FLAT PIECE OF MILD STEEL WITH A HAND-HELD OXY-ACETYLENE CUTTING TORCH

- Lay out pattern on metal using soapstone and straight edge
- Cut thin metal in straight line
- Inspect cut edges

COMPETENCY NO. 2 – TO FUSION WELD MILD STEEL IN A FLAT POSITION USING THE OXY-ACETYLENE PROCESS

- Select filler rod
- Form a molten puddle
- Weld in flat position
- Weld a butt joint
- Weld a lap joint
- Weld an open corner joint
- Weld a T-joint
- Test welds
- Tack weld metal prior to welding
- Clean metal

COMPETENCY NO. 3 – TO FUSION WELD MILD STEEL IN A HORIZONTAL POSITION USING THE OXY-ACETYLENE PROCESS

- Select filler rod
- Form a molten puddle
- Weld in horizontal position
- Weld a butt joint
- Weld a lap joint
- Weld an open corner joint
- Weld a T-joint
- Test welds
- Tack weld metal prior to welding
- Clean metal

COMPETENCY NO. 4 – TO FUSION WELD MILD STEEL IN A VERTICAL POSITION USING
OXY-ACETYLENE PROCESS

- Select filler rod
- Form a molten puddle
- Weld in vertical position
- Weld a butt joint
- Weld a lap joint
- Weld an open corner joint
- Weld a T-joint
- Test welds
- Tack weld metal prior to welding
- Clean metal

COMPETENCY NO. 5 – TO FUSION WELD MILD STEEL IN AN OVERHEAD POSITION USING
OXY-ACETYLENE PROCESS

- Select filler rod
- Form a molten puddle
- Weld in overhead position
- Weld a butt joint
- Weld a lap joint
- Weld an open corner joint
- Weld a T-joint
- Test welds
- Tack weld metal prior to welding
- Clean metal

COMPETENCY NO. 6 – TO BRAZE WELD MILD STEEL IN A FLAT AND HORIZONTAL POSITION
USING THE OXY-ACETYLENE PROCESS

- Select filler rod
- Weld in flat position
- Weld a butt joint
- Weld a lap joint
- Weld a T-joint
- Test welds
- Tack weld metal prior to welding
- Clean metal
- Weld in horizontal position
- Select and apply flux or use flux-coated filler rod
- Heat base metal to correct temperature
- Select proper rod diameter

COMPETENCY NO. 7 THROUGH COMPETENCY NO. 11

GENERAL TASKS:

- Practice safe welding procedures according to A.W.S., ANSI-Z49.1 as applied to arc welding
- Set up the welding station
- Measure plate steel with steel rule
- Operate a transformer-type AC welder
- Operate DC motor-driven welder
- Operate power hacksaw, bandsaw or shear
- Make proper machine adjustment for the electrode
- Select material for the job
- Cut material for the job
- Interpret shop drawings and blueprints
- Set power source
- Set (2) operating adjustments

- Inspect welds
- Start the arc (tap and scratch methods)
- Select proper welding rod diameters
- Start, stop and restart a bead
- Prevent arc blow
- Select welding electrodes for different types of metals by number and/or color code
- Remove slag from a weld
- Test welds

COMPETENCY NO. 7 – TO FUSION WELD CONTINUOUS AND PARALLEL STRINGER BEADS
USING THE SHIELDED METAL ARC WELDING PROCESS

- Layout lines on plate steel with soapstone
- Arc weld in the flat position

COMPETENCY NO. 8 – TO FUSION WELD IN A FLAT POSITION A MULTIPLE-PASS BUILD UP
USING THE SHIELDED METAL ARC WELDING PROCESS

- Arc weld in the flat position
- Multiple-pass weld in the flat position
- Inspect the cross-section of a multiple-pass weld

COMPETENCY NO. 9 – TO FUSION WELD MILD STEEL IN THE FLAT POSITION USING THE
SHIELDED METAL ARC WELDING PROCESS

- Select parts of groove and fillet welds
- Prepare ferrous metal for arc welding
- Operate power grinder
- Set-up for the type of joint
- Arc weld various size steel plates
- Tack weld plates in the proper joint alignment
- Make a fillet weld
- Weld in the flat position
- Make butt joint welds in the flat position
- Arc weld lap joint in the flat position
- Arc weld T-joint in the flat position
- Arc weld open corner joint in the flat position

COMPETENCY NO. 10 – TO FUSION WELD MILD STEEL IN A HORIZONTAL POSITION USING
THE SHIELDED METAL ARC WELDING PROCESS

- Select parts of groove and fillet welds
- Prepare ferrous metal for arc welding
- Operate power grinder
- Set-up for the type of joint
- Arc weld various size steel plates
- Tack weld plates in the proper joint alignment
- Arc weld in the horizontal position
- Construct a single pass T-joint in the horizontal position
- Weld an open corner joint in the horizontal position
- Weld a lap joint in the horizontal position

COMPETENCY NO. 11 – TO FUSION WELD MILD STEEL IN A VERTICAL POSITION USING THE
SHIELDED METAL ARC WELDING PROCESS

- Select parts of groove and fillet welds
- Prepare ferrous metal for arc welding
- Operate power grinder
- Set up for the type of joint
- Arc weld various size steel plates
- Tack weld plates in the proper joint alignment

Use proper electrode manipulations
Arc weld in the vertical position
Construct a single pass T-joint in the vertical position
Weld an open corner joint in the vertical position
Weld a lap joint in the vertical position

COMPETENCY NO. 12 THROUGH COMPETENCY NO. 14

GENERAL TASKS:

Practice safe welding procedures according to A.W.S., ANSI-Z49.1 *Safety in Welding and Cutting*
Set up constant voltage power supply for direct current reverse polarity
Start welding machine
Set machine voltage
Set machine inductance (if equipped)
Set machine slope (if equipped)
Install welding wire
Install wire drive rollers
Adjust tension on wire feed rollers
Blow out wire conduit with compressed air
Set up gun
Hook up gun to wire-drive assembly
Inch wire out through gun
Install contact tip
Adjust and maintain correct stick out
Install shielding gas nozzle
Set wire feed speed
Shut off shielding gas system
Bleed gas lines
Turn off welding power supply
Store gun and cable
Inspect welds
Interpret blueprints and shop drawings

COMPETENCY NO. 12 — TO FUSION WELD MILD STEEL IN A FLAT POSITION USING THE GAS METAL ARC WELDING PROCESS

Select CO₂ cylinder by color coding
Crack cylinder valve on CO₂ cylinder
Attach regulator and flow meter to CO₂ cylinder
Adjust cubic feet per hour on flowmeter
Position plates for tack welding
Tack weld
Weld an outside corner joint
Weld a lap joint
Weld a T-joint
Weld a square groove joint with 1/8" root gap
Arc weld in the horizontal position
Break-test T-joint
Start, stop and restart beads

COMPETENCY NO. 13 — TO FUSION WELD MILD STEEL IN A HORIZONTAL POSITION USING THE GAS METAL ARC WELDING PROCESS

Select CO₂ cylinder by color coding
Crack cylinder valve on CO₂ cylinder
Attach regulator flowmeter to CO₂ cylinder

- Adjust cubic feet per hour on flowmeter
- Position plates for tack welding
- Tack weld
- Weld an outside corner joint
- Weld a lap joint
- Weld a T-joint
- Weld a square groove joint with 1/8" root gap
- Arc weld in the horizontal position
- Break-test T-joint
- Start, stop and restart beads

COMPETENCY NO. 14 – TO FUSION WELD MILD STEEL IN A FLAT POSITION USING THE GAS METAL ARC WELDING PROCESS WITH THE SPRAY TRANSFER TECHNIQUE

- Select Argon-O₂ cylinder by color coding
- Attach regulator flowmeter to cylinder
- Adjust cubic feet per hour on flowmeter
- Weld and readjust machine settings (if necessary)
- Position and clamp plates for tack welding
- Tack weld
- Position plates for welding in the flat position
- Spray arc weld
- Cut out coupon strips for U bending
- Remove backup strip
- Air-cool coupons to room temperature before bending
- U-bend roots of two coupons
- U-bend face of two coupons

COMPETENCY NO. 15 THROUGH COMPETENCY NO. 20

GENERAL TASKS:

- Tack weld joints
- Mechanically clean base plate
- Chemically clean base plate
- Select the proper filler wire
- Select the alloys by their alloy numbers
- Adjust power source current
- Select constant current power source
- Select shielding gas type by cylinder color
- Select AC current
- Select D.C.R.P. current
- Change tungsten electrode in torch
- Check gas supply hose for leaks
- Select tungsten type
- Select electrode diameter
- Adjust the high frequency rheostat
- Electrically ball a tungsten electrode
- Select the proper gas cup or nozzle by type and size
- Practice safe welding procedures according to A.W.S., ANSI-Z49.1 *Safety in Welding and Cutting for T.I.G. Welding*
- Make non-touch starts
- Make a weld pool and add filler metal making a continuous bead
- Adjust the flowmeter to proper C.F.H.
- Grind tungsten electrode
- Attach regulator flowmeter to cylinder
- Interpret blueprints and shop drawings

ENABLING TASKS
(Continued)

COMPETENCY NO. 15 – TO WELD BEADS ON ALUMINUM PLATE IN A FLAT POSITION USING THE GAS TUNGSTEN ARC WELDING PROCESS

Use general tasks

COMPETENCY NO. 16 – TO MAKE FLAT POSITION SINGLE PASS FILLET WELDS ON ALUMINUM SHEET USING THE GAS TUNGSTEN ARC WELDING PROCESS

Weld a T-joint

Set up and use a power hacksaw and/or bandsaw

COMPETENCY NO. 17 – TO MAKE FLAT POSITION SINGLE PASS BUTT WELDS ON ALUMINUM SHEET USING THE GAS TUNGSTEN ARC WELDING PROCESS

Weld a groove joint

Set up and use a power hacksaw and/or bandsaw

Set up and use a guided bend testing machine

COMPETENCY NO. 18 – TO MAKE FLAT POSITION MULTI-PASS FILLET WELDS ON ALUMINUM PLATE USING THE GAS TUNGSTEN ARC WELDING PROCESS

Weld a T-joint

Preheat base plate

Set up and use a power hacksaw and/or bandsaw

Make a caustic solution

Acid-etch a weld cross-section

COMPETENCY NO. 19 – TO MAKE FLAT POSITION MULTI-PASS WELDS ON ALUMINUM PLATE USING THE GAS TUNGSTEN ARC WELDING PROCESS

Weld a groove joint

Preheat a base plate

Set up and use a power hacksaw and/or bandsaw

Set up and use a guided bend testing machine

Make a caustic solution

Acid-etch a weld cross-section

COMPETENCY NO. 20 – TO MAKE HORIZONTAL MULTI-PASS WELDS ON ALUMINUM PLATE USING THE GAS TUNGSTEN ARC WELDING PROCESS

Weld a T-joint

Weld a groove joint

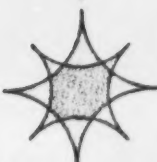
Preheat base plate

Set up and use a power hacksaw and/or bandsaw

Set up and use a guided bend testing machine

Make a caustic solution

Acid-etch a weld cross-section



Glossary

Items included are subject to different interpretations. These definitions are applicable for use in context of this material.

GLOSSARY

A.W.S.

See American Welding Society

Acceptable storage and working conditions

All parts and equipment returned to a specified location and stored in a safe manner and operable condition.

Aluminum Association

750 Third Avenue, New York, N.Y. 10017

American Welding Society

Headquarters located at 2501 N.W. 7th Street, Miami, Florida 33125

Hobart Brothers Co.

Box EW-434, 1221 Hobart Road, Troy, Ohio 45373

Safe manner

Performance completed without damage to equipment, self or other persons.

Smith Welding Equipment

2633 S.E. 4th Street, Minneapolis, Minnesota 55414

Union Carbide Corporation

Dept. PP, Box 363-B, Tuxedo, New York 07083



Individual Student Record

A complete and accurate record may be used by students for job applications and for planning post-secondary education. For reference purposes, photocopies of individual student records may be given to the student. Original copies of all records should remain in the Student Services Department of the school.

WELDING

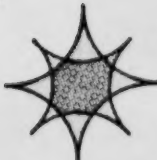
Name of Student _____

School Stamp

This is to certify that the above named student has demonstrated proficiency in the following tasks:

Comp	Task	Date Completed	Instructor
1.	Cut with hand-held oxy-acetylene torch		
2.	Fusion weld in flat position using oxy-acetylene welder		
3.	Fusion weld in horizontal position using oxy-acetylene welder		
4.	Fusion weld in vertical position using oxy-acetylene welder		
5.	Fusion weld in overhead position using oxy-acetylene welder		
6.	Braze weld in flat and horizontal position using oxy-acetylene welder		
7.	Weld stringer beads in flat, horizontal and vertical position using arc welder		
8.	Make pad in flat position using arc welder		
9.	Weld "T", lap, and butt joints in flat position using arc welder		
10.	Weld open corner, "T" and lap joints in horizontal position using arc welder		
11.	Weld open corner, "T" and lap joints in vertical-down position using arc welder		
12.	Weld outside corner, lap, "T" and butt joints in flat position using GMAW welder		

Comp	Task	Date Completed	Instructor
13.	Weld outside corner, lap, "T" and butt joints in horizontal position using GMAW welder		
14.	Weld butt joint in flat position using spray transfer technique using GMAW welder		
15.	Weld stringer beads in flat position on aluminum using TIG welder		
16.	Weld "T" single-pass fillet beads on aluminum in flat position using TIG welder		
17.	Weld single-pass butt joints with aluminum in flat position using TIG welder		
18.	Weld "T" multi-pass fillet beads on aluminum in flat position using TIG welder		
19.	Weld multi-pass butt joints with aluminum in flat position using TIG welder		
20.	Weld multi-pass "T" fillet beads on aluminum in horizontal position using TIG welder		



Class Competency Record

It is important that complete and accurate competency records be maintained for all students. Teachers, administrators, students and people in business and industry may benefit from this information.

40

48